dimensional array which comprises separate alternating plates of acoustic backing material and printed circuit substrates with conductive traces, the separate plates and printed circuit substrates being bonded together with adhesive located between the adjoining surfaces of the plates and the printed circuit substrates. The conductive backing block assembly can be made separate from the array and then affixed to the array in a finished condition. The assembly is structurally different from the backing shown in Kawabe et al., as it includes plates of acoustic backing material and printed circuit substrates; in Kawabe et al. there are no plates of backing material, only a block of backing after the backing is cast and cured. Furthermore, Claim 1 calls for the plates and printed circuit substrates to be bonded together with adhesive, which is nowhere found or mentioned in Kawabe et al. In Kawabe et al. the backing is simply molded around the printed circuits. For all of these reasons it is respectfully submitted that Claim 1 and its dependent Claims 2-8 are not anticipated by Kawabe et al.

Claim 9 describes a two dimensional ultrasonic transducer array probe comprising a two dimensional array of ultrasonic transducer elements having a bottom surface from which undesired ultrasonic energy is emitted; and a conductive backing block assembly affixed in opposition to the bottom surface of the two dimensional array which comprises a series of plates of acoustic backing material with conductive traces formed thereon which are adhesively bonded together. This invention advantageously eliminates the printed circuit substrates by using backing plates with conductive traces form on them, which is nowhere found or suggested in Kawabe et al. The plates with their traces are adhesively bonded together, which is also no shown or suggested by Kawabe et al. Accordingly it is respectfully submitted that Claim 9 and its dependent Claims 10-16 are not anticipated by Kawabe et al.

Claim 28 describes a two dimensional ultrasonic transducer array probe comprising a two dimensional array of ultrasonic transducer elements having top faces, bottom faces, and electroded lateral faces which operate in the k_{31} mode; and a conductive backing block assembly affixed in opposition to the bottom faces of the two dimensional array elements which comprises alternating layers of acoustic backing material and printed circuit substrates with conductive traces bonded together. A two dimensional array which operates in the k_{31} mode is not shown or suggested in Kawabe et al. US Pat. 6,288,477 which was prosecuted by applicant's attorney and the Examiner last year (enclosed) shows a k_{31} array, but indicates

(col. 4, lines 21-24) nothing beyond the familiar embedded flex circuit backing shown in Kawabe et al. Accordingly it is respectfully submitted that Claim 28 and its dependent Claims 29 and 30 are patentable over these patents.

Claim 31 describes a two dimensional ultrasonic transducer array probe comprising a two dimensional array of ultrasonic transducer elements having top faces, bottom faces, and electroded lateral faces which operate in the k_{31} mode; and a conductive backing block assembly affixed in opposition to the bottom faces of the two dimensional array elements which comprises a series of plates of acoustic backing material with conductive traces formed thereon which are bonded together. Kawabe et al. do not show or suggest an array operating in the k_{31} mode, nor the use of plates of backing material with conductive traces on them, nor the bonding together of such plates. For all of these reasons it is respectfully submitted that Claims 31 and 32 are patentable over Kawabe et al.

Claims 12 and 17-27 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kawabe et al. either alone or in combination with US Pat. 5,329,498 (Greenstein). Claims 12 and 22 call for the use of backing material plates which are of different lengths so that the conductive traces can all be accessed at the back of the backing block assembly. Greenstein uses a rectangular backing block 16. Behind this is a block of laminated semiconductor chips of varying lengths. However, this is a laminate of semiconductor devices, not backing material. When it comes to a backing block assembly, Greenstein shows a conventional rectangular block 16. It is only the present application which suggests backing material plates of different lengths; Greenstein does not even use backing material plates, but a single unitary block. Accordingly it is respectfully submitted that Claims 12 and 22 are patentable over Kawabe et al. and Greenstein.

Claim 17 describes a conductive backing block assembly for a two dimensional ultrasonic transducer array comprising plates of acoustic backing material; and printed circuit substrates located between the plates of acoustic backing material and having conductive traces, wherein the plates and printed circuit substrates are bonded together with adhesive located between the adjoining surfaces of the plates and printed circuit substrates. Kawabe et al. does not use backing material plates, they cast a backing block. And Kawabe et al. do not bond backing material plates and printed circuits together with adhesive; there is no adhesive in Kawabe et al. This is not a case of dividing one element into two elements, as the Examiner suggests. Claim 17 plainly recites the use of

an element not found in Kawabe et al., adhesive to bond the plates and printed circuit substrates together. There is no adhesive in Kawabe et al. Kawabe et al. call for epoxy, but as a component of their casting compound, not as a bonding adhesive. For these reasons it is respectfully submitted that Claim 17 and its dependent Claims 18 and 19 are patentable over Kawabe et al.

Claim 20 describes a conductive backing block assembly for a two dimensional ultrasonic transducer array comprising plates of acoustic backing material having conductive traces formed thereon, wherein the plates are adhesively bonded together. Kawabe et al. does not show or suggest backing material plates with conductive traces formed on them. Accordingly it is respectfully submitted that Claim 20 and its dependent Claims 21-23 are patentable over Kawabe et al.

Claim 24 describes a two dimensional ultrasonic transducer array probe comprising a two dimensional array of micromachined ultrasonic transducer elements having a bottom surface from which undesired ultrasonic energy is emitted; and a conductive backing block assembly affixed in opposition to the bottom surface of the two dimensional array which comprises separate alternating plates of acoustic backing material and printed circuit substrates with conductive traces, the separate plates and printed circuit substrates being bonded together with adhesive located between the adjoining surfaces of the plates and the printed circuit substrates. Kawabe et al. do not show or suggest the use of micromachined transducer elements, but only conventional piezoelectric ceramic. They also do not call for separate plates of backing material and printed circuits bonded together with adhesive. They use a conventionally cast backing block. For these reasons it is respectfully submitted that Claim 24 and its dependent Claims 25-27 are patentable over Kawabe et al.

In light of the foregoing amendment and remarks, it is respectfully submitted that Claims 1-32 are patentable over the Kawabe et al. and Greenstein patents. Accordingly it is respectfully requested that the rejection of Claims 1-11, 13-16 and 28-32 under 35 U.S.C. §102(b) and of Claims 12 and 17-27 under 35 U.S.C. §103(a) be withdrawn.

In light of the foregoing amendment and remarks, it is respectfully submitted that this application is now in condition for allowance. Favorable reconsideration is respectfully requested.

Respectfully submitted,

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Appendix: Version with markings to show changes made

Paragraph beginning on page 9, line 30 of the specification:

FIGURES 4a-4e illustrate the construction of a transducer stack of the present invention which is to be operated in the k_{31} mode as described, for instance, in U.S. Patent 6,288,477 [appl. serial number 09/457,196, filed December 3, 1999]. Rather than conventional excitation longitudinally between the top (patient-facing side) and bottom of the element, in the k_{31} mode a transducer element is poled and excited laterally. This enables the electrodes of the element to be located on the sides of an element rather than the top and bottom. In the example of FIGURE 4a the piezoelectric plate 22 is adhesively attached to the conductive backing block assembly 50 which contains embedded flex circuits 12a, 12b, and 12c, but could also comprise backing plates with etched conductors as described above. Unlike the example of FIGURE 3, in this embodiment there are no gold plated electrodes between the piezoelectric plate and the assembly 50; the piezoelectric is simply attached to the finished surface of the assembly 50. In FIGURE 4b the piezoelectric plate 22 is diced in the elevation dimension to form columns of piezoelectric material across the backing block and its rows of flex circuit 12a, 12b, and 12c. These dicing cuts 30 are made in line with conductive traces on the underlying flex circuit so that the ends of the traces are located in the bottoms of the cuts 30. In FIGURE 4c the lateral, opposing walls 32 within the cuts 30 are plated with electrode material, which may be applied by wet plating, evaporation, or a sputtering process. This electrode material lines both lateral piezoelectric walls 32 of the dicing cuts 30, as well as the bottom of the cut where the conductive traces end. Thus, this electroding electrically connects the conductive traces in the bottom of the cuts to the lateral sides of the piezoelectric on either side of the respective cuts.